

# Using Epidemiology to Influence Public Policy

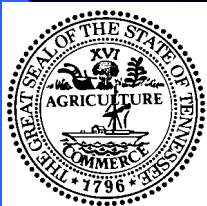
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*Epidemiologist*

dchapman2@mail.state.tn.us

**Tennessee Department of Health**  
Bureau of Health Informatics

November 7, 2001



# Perinatal Risk Factors for Morbidity vs Mortality

# Developmental Epidemiology

- *Developmental epidemiology* is the study of the distribution of behavioral outcomes in infancy and childhood and the indicators of their occurrence
- *Risk factor* refers to any characteristic of a person, place, or time
  - Identifiable prior to the event
  - Can be causal or a marker for other factors

# Developmental Disabilities

- A group of heterogeneous conditions that are attributable to mental and/or physical impairments, manifested before the person attains the age of 22 years, and likely to continue indefinitely. . .
  - Mental retardation
  - Learning disabilities
  - Autism
  - Others

# Do Epi Methods Apply to Developmental Disabilities?

- Like chronic disease, developmental disabilities:
  - Have a late onset (identification)
  - Are multi-factorial in causation
  - Are generally neither fatal nor easily remedied

# Early Intervention Risk Model

- Select an adverse outcome to target
- Identify source of risk associated with outcome
- Design strategy to prevent risk occurrence
- Develop an intervention component or identify agency to provide prevention service

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graph LR; D[DESCRIPTIVE: Distribution of diseases in population subgroups (Cross sectional studies)] --> HCP[HEALTH CARE PLANNING]; E[ETIOLOGIC: Associations among variables, temporal relationships (case-control and prospective studies)] --> FH[FORMATION OF HYPOTHESES]; Ex[EXPERIMENTAL: Testing of interventions (clinical trials)] --> SMP[STANDARDS OF MEDICAL PRACTICE]; D -- "(suggesting)" --> E; E -- "(suggesting)" --> Ex; HCP -- "EMERGENCE OF PATTERNS" --> E; FH --> SMP
```

The diagram illustrates the relationship between three levels of epidemiology and their respective applications. It is structured as a flowchart with three main horizontal paths and two vertical feedback loops.

- DESCRIPTIVE:** Distribution of diseases in population subgroups (Cross sectional studies) → **HEALTH CARE PLANNING,**
- ETIOLOGIC:** Associations among variables, temporal relationships (case-control and prospective studies) → **FORMATION OF HYPOTHESES**
- EXPERIMENTAL:** Testing of interventions (clinical trials) → **STANDARDS OF MEDICAL PRACTICE**

Vertical connections and feedback loops:

- A line from **HEALTH CARE PLANNING,** points down to **ETIOLOGIC:** with the label **EMERGENCE OF PATTERNS**.
- A line from **FORMATION OF HYPOTHESES** points down to **EXPERIMENTAL:** with the label **(suggesting)**.
- A line from **EXPERIMENTAL:** points up to **ETIOLOGIC:** with the label **(suggesting)**.

**Distribution of diseases in population subgroups — (Cross sectional studies)**

**HEALTH  
CARE  
PLANNING,**

- (suggesting)

## EMERGENCE OF PATTERNS

**Associations among variables, temporal relationships (case-control and prospective studies)**

## FORMATION OF HYPOTHESES

- (suggesting)

## Testing of interventions (clinical trials)

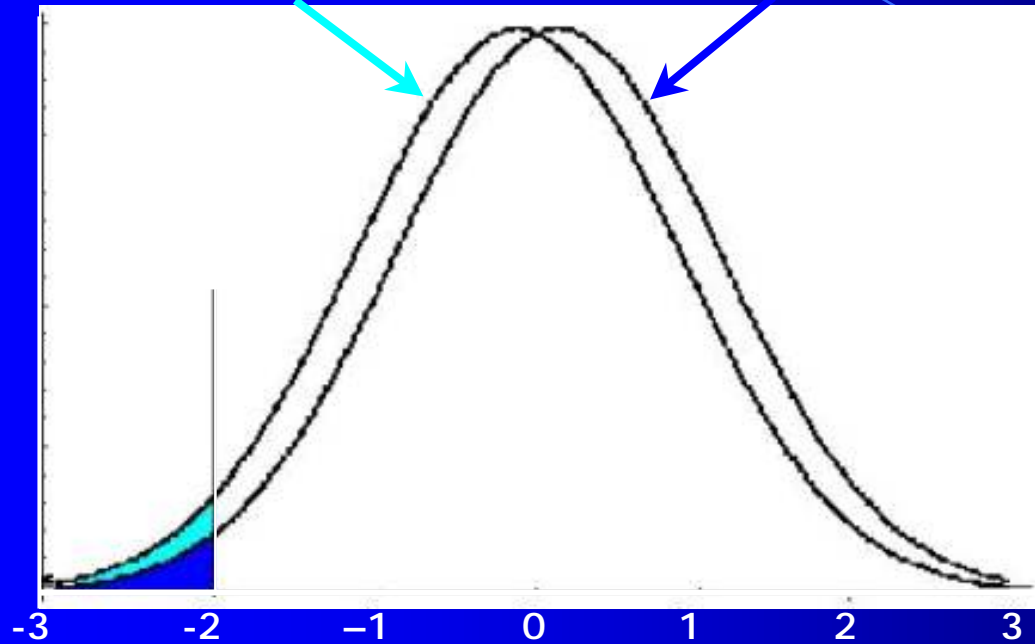
## STANDARDS OF MEDICAL PRACTICE

# Samples

- **Florida:** 1982-1984 birth certificates linked to 1996-97 public school records (ages 13 to 15 yrs)
  - N= 267,277 (43,055 (16%) special ed, not gifted)
- **Florida:** 1989-1990 birth certificates linked to 1997-98 public school records (ages 7 to 8 yrs)
  - N= 245,787 (41,612 (17%) special ed, not gifted)
- **Tennessee:** Birth/death certificate linked file for 1989-1990 TN resident births
  - 145,355 live births (1,487 (1%) infant deaths)

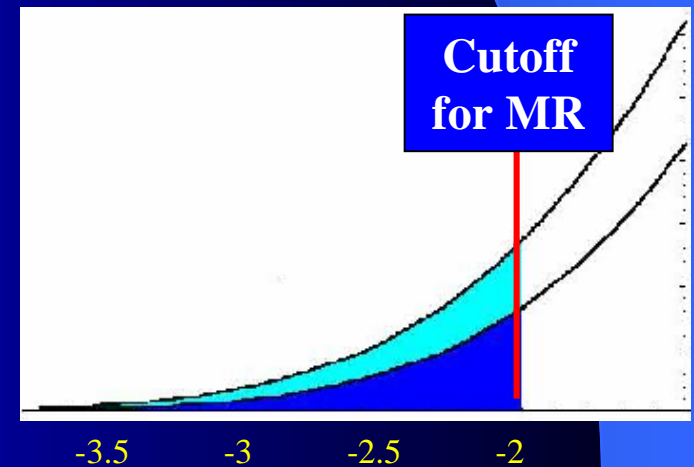
**Original  
Population**

**After  
Intervention**



Standard Deviations from the aggregated  
mean of two distributions

**Cutoff  
for MR**



# Epidemiological Methods

- Focus on proportions of cases
  - Low incidence conditions
  - Policy decisions
- Separate risk to individual from risk to the population

Risk Factor	Individual-Risk	Population-Risk
<i>Rare (LBW)</i>	High	Low
<i>Common (Poverty)</i>	Low	High

# Risk Ratio (RR) (FL 82-84)

- Relative increase in probability of a given outcome when one rather than another condition is true

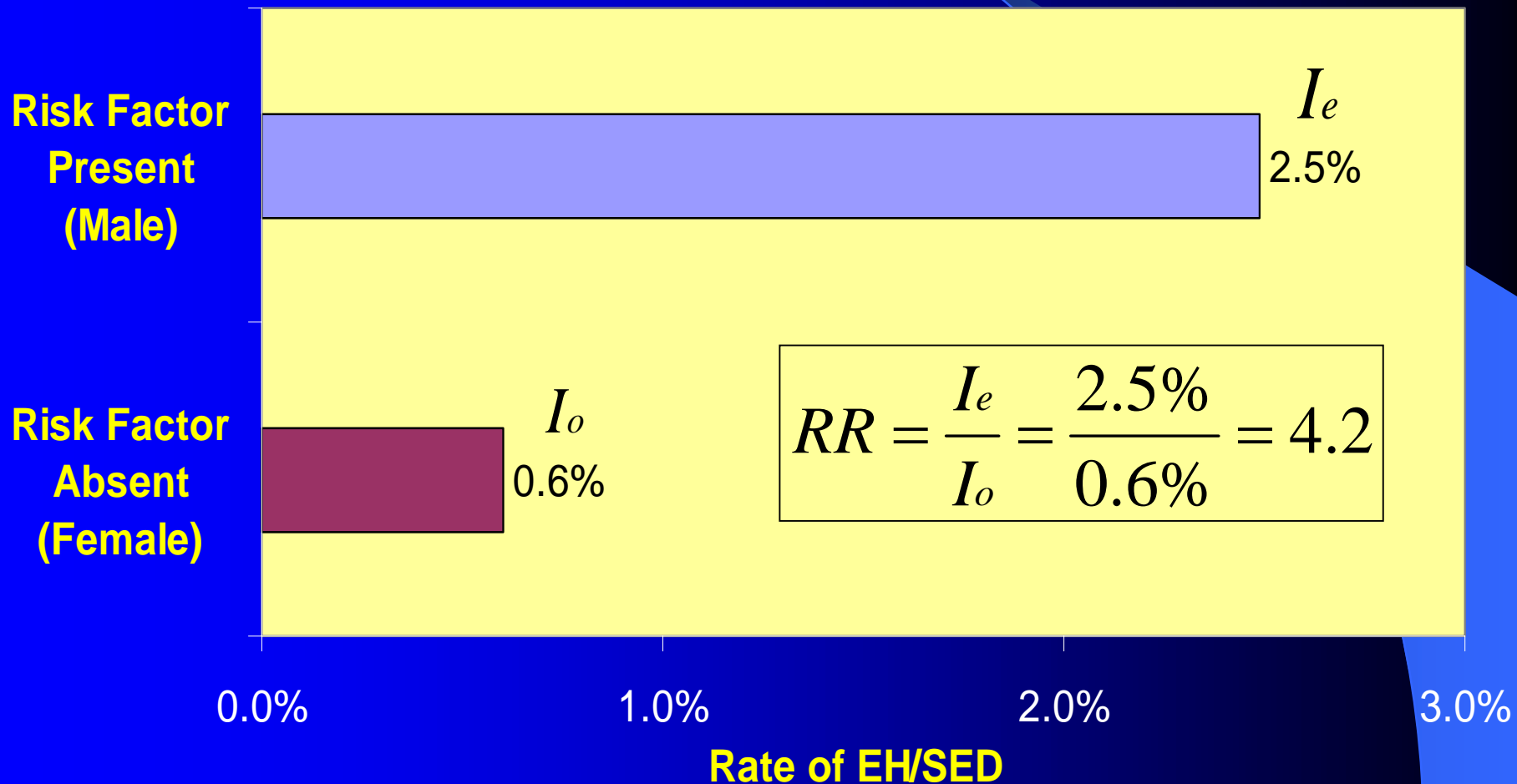
RISK FACTOR	OUTCOME	
	Present	Absent
	Present	Absent
	<i>a</i>	<i>b</i>
	<i>c</i>	<i>d</i>

$$RR = \frac{a/(a+b)}{c/(c+d)} = \frac{I_e}{I_o}$$

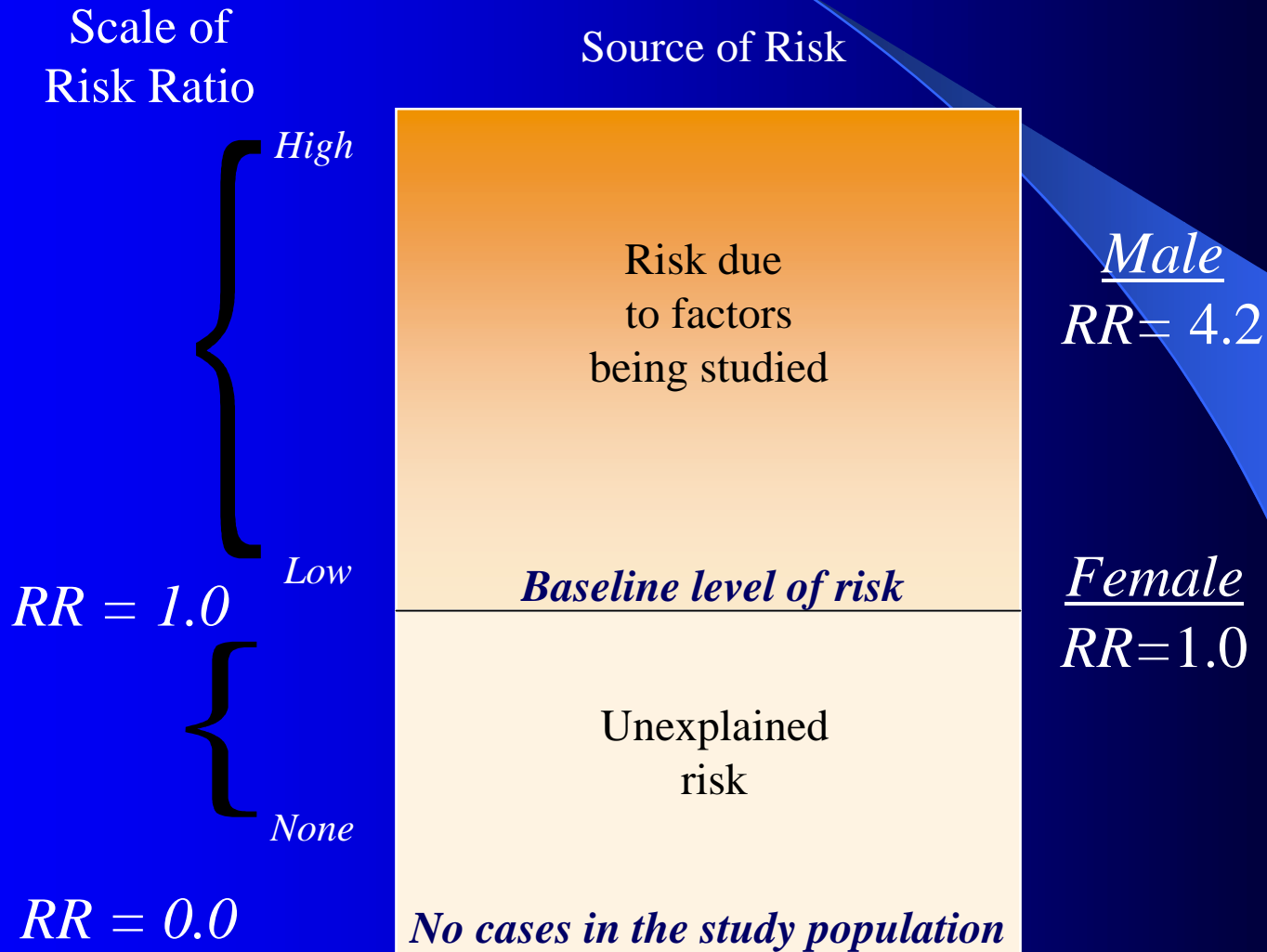
Sex	EH/SED	No Special Education	Probability of EH/SED
<i>Male</i>	2,523	98,766	.025
<i>Female</i>	636	105,409	.006

$$RR_{male} = \frac{2,553/101,289}{636/106,045} = \frac{.025}{.006} = 4.2$$

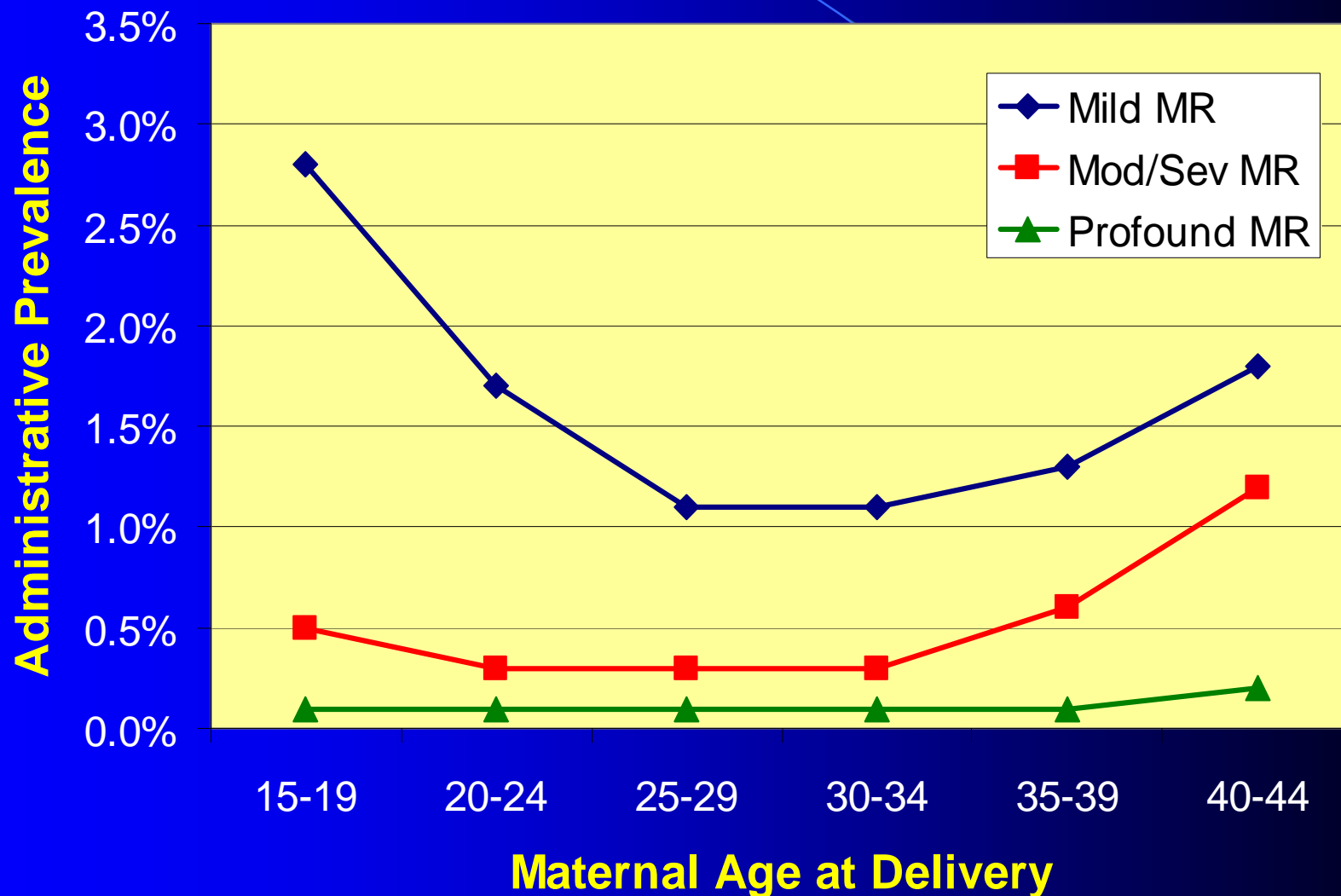
# Risk Ratio Example (FL 82-84)



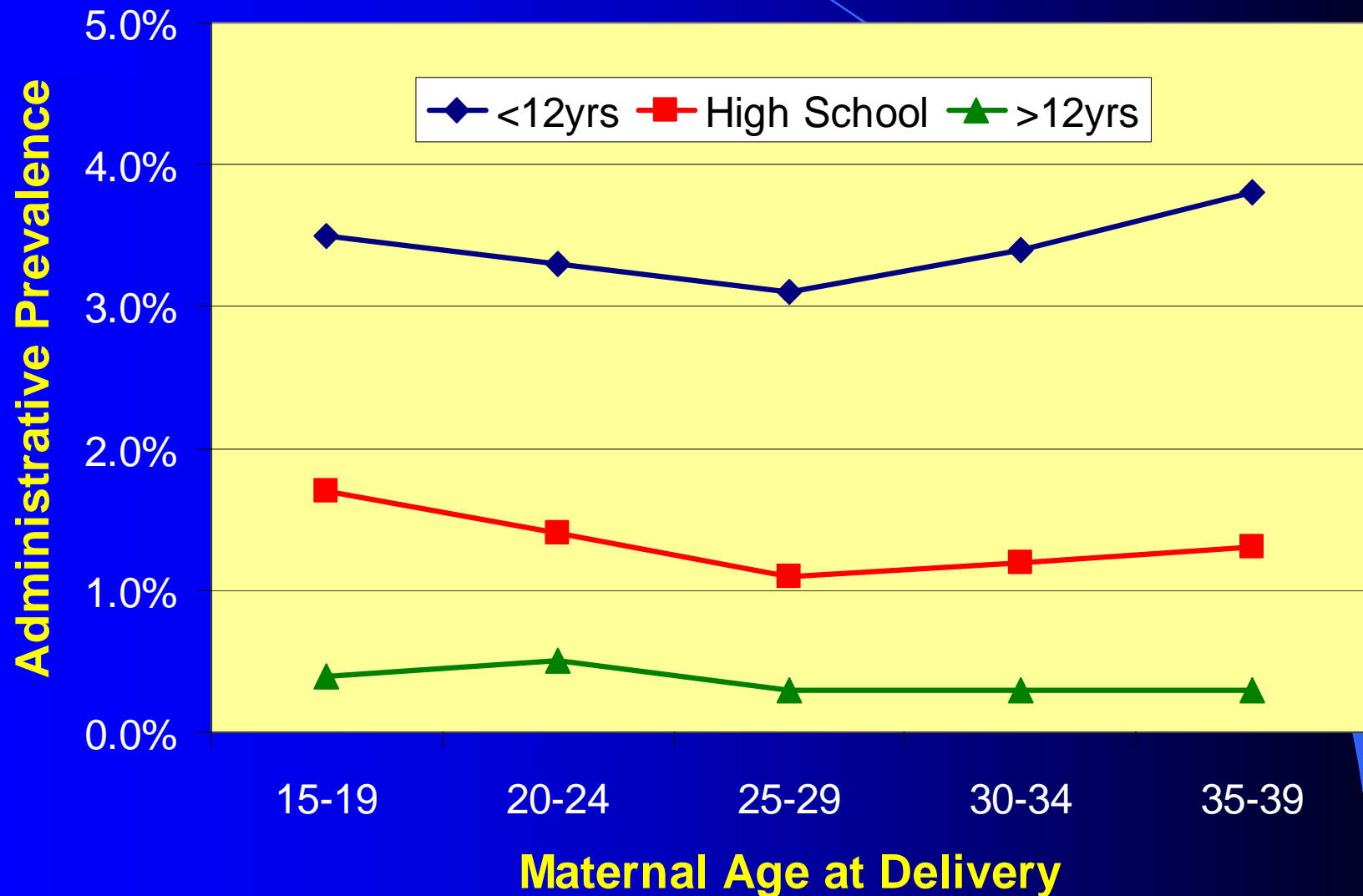
# Epidemiological Concept of Risk Analysis



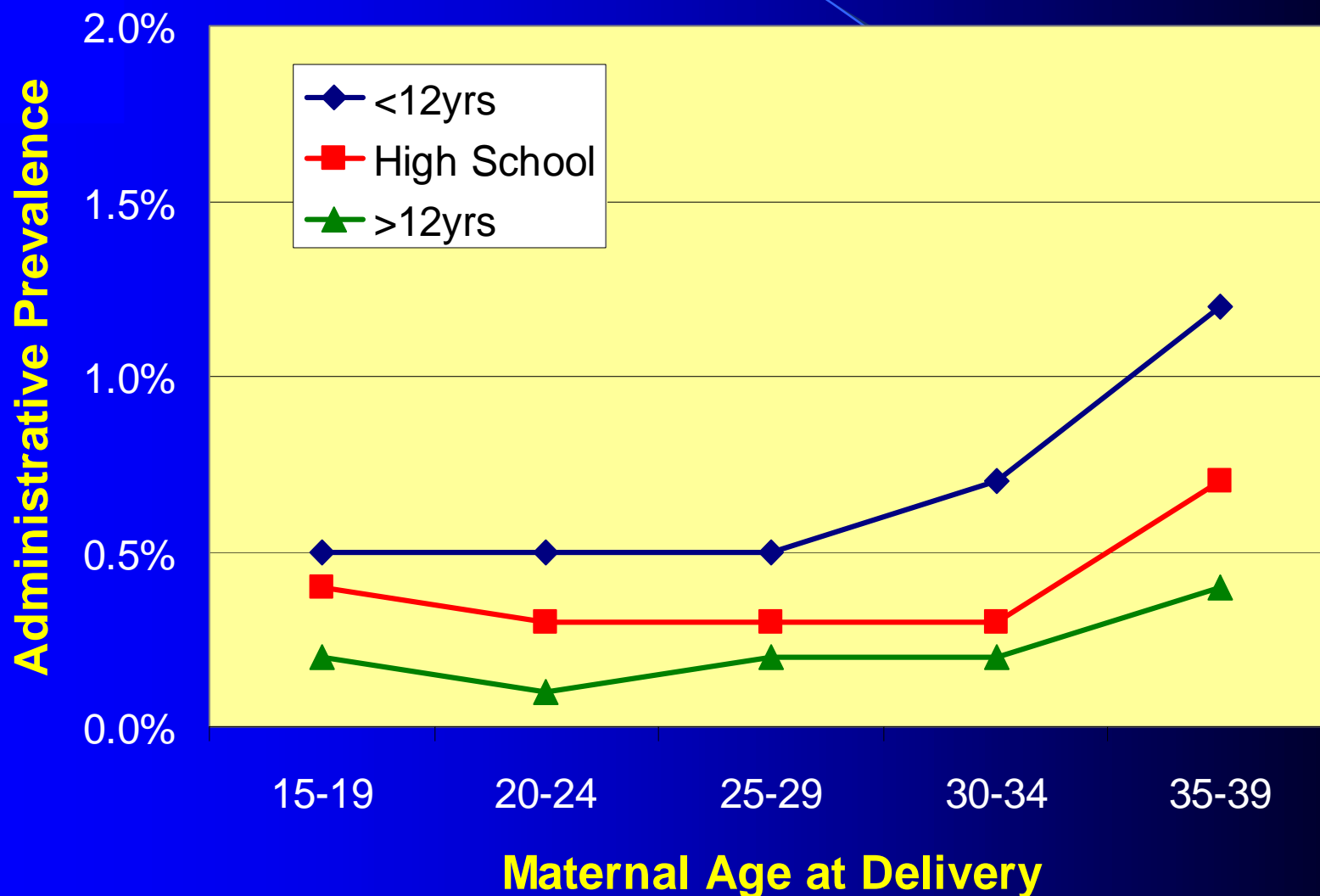
# MR by Maternal Age (FL 82-84)



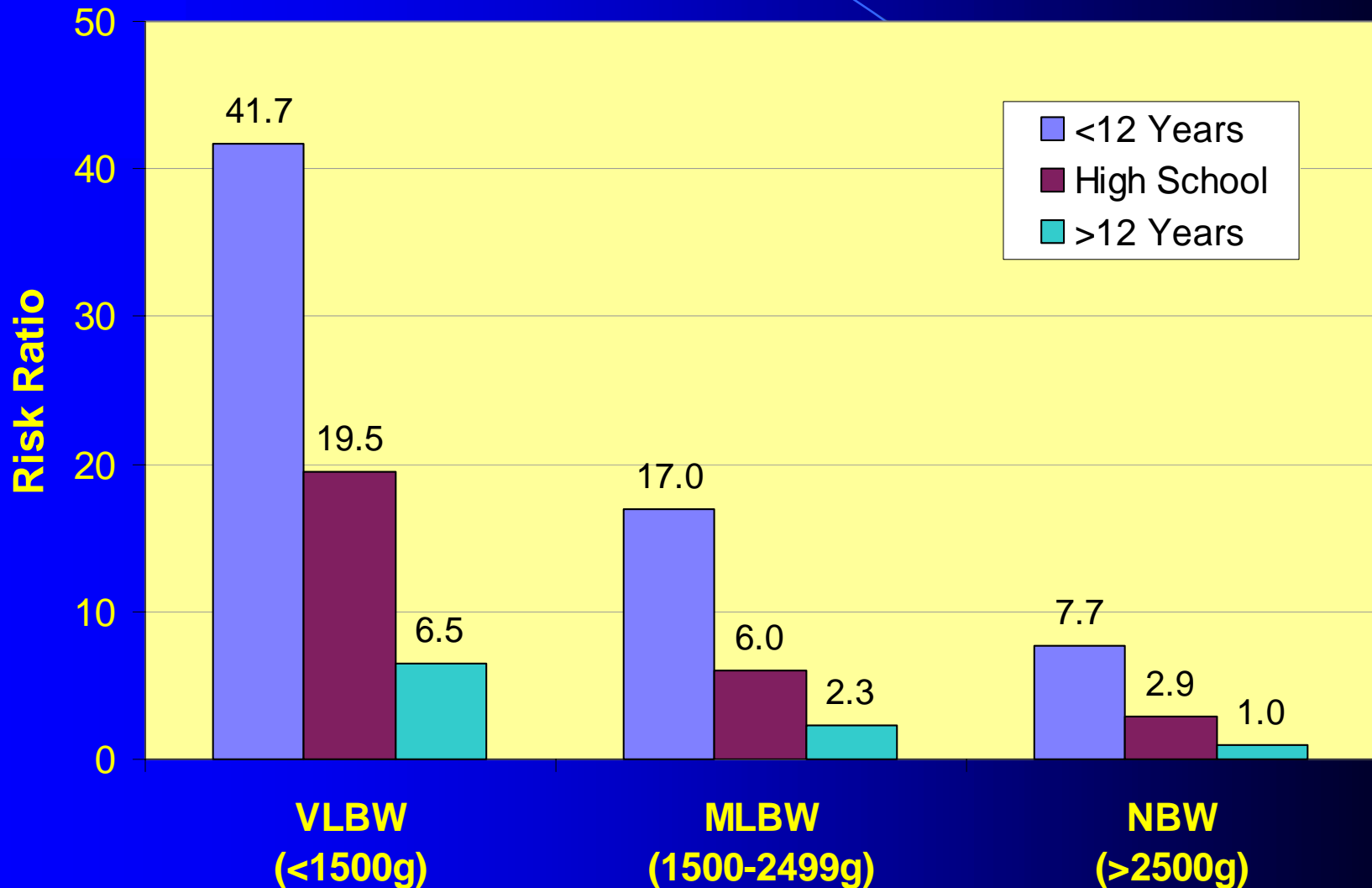
# Mild MR: Maternal Age x Maternal Education (FL 82-84)



# Mod/Sev. MR: Maternal Age x Maternal Education (FL 82-84)



# Mild MR: Birth Weight (BW) x Maternal Education (FL 79-80)



# RR(95%CI) (FL & TN 89-90)

## Infant Mortality

<i>apgar &lt;4</i>	131.4 (119.7-144.3)
<i>vlbw</i>	88.5 (79.7-98.4)
<i>apgar 4-6</i>	31.7 (27.8-36.1)
<i>pre-term</i>	17.4 (15.6-19.4)

## EH/SED

<i>male</i>	4.2 (3.8-4.5)
<i>mom ed &lt;12</i>	3.7 (3.4-4.1)
<i>dad ed &lt;12</i>	3.2 (2.8-3.7)
<i>apgar &lt;4</i>	3.1 (1.6-6.1)
<i>unmarried</i>	3.1 (2.8-3.2)

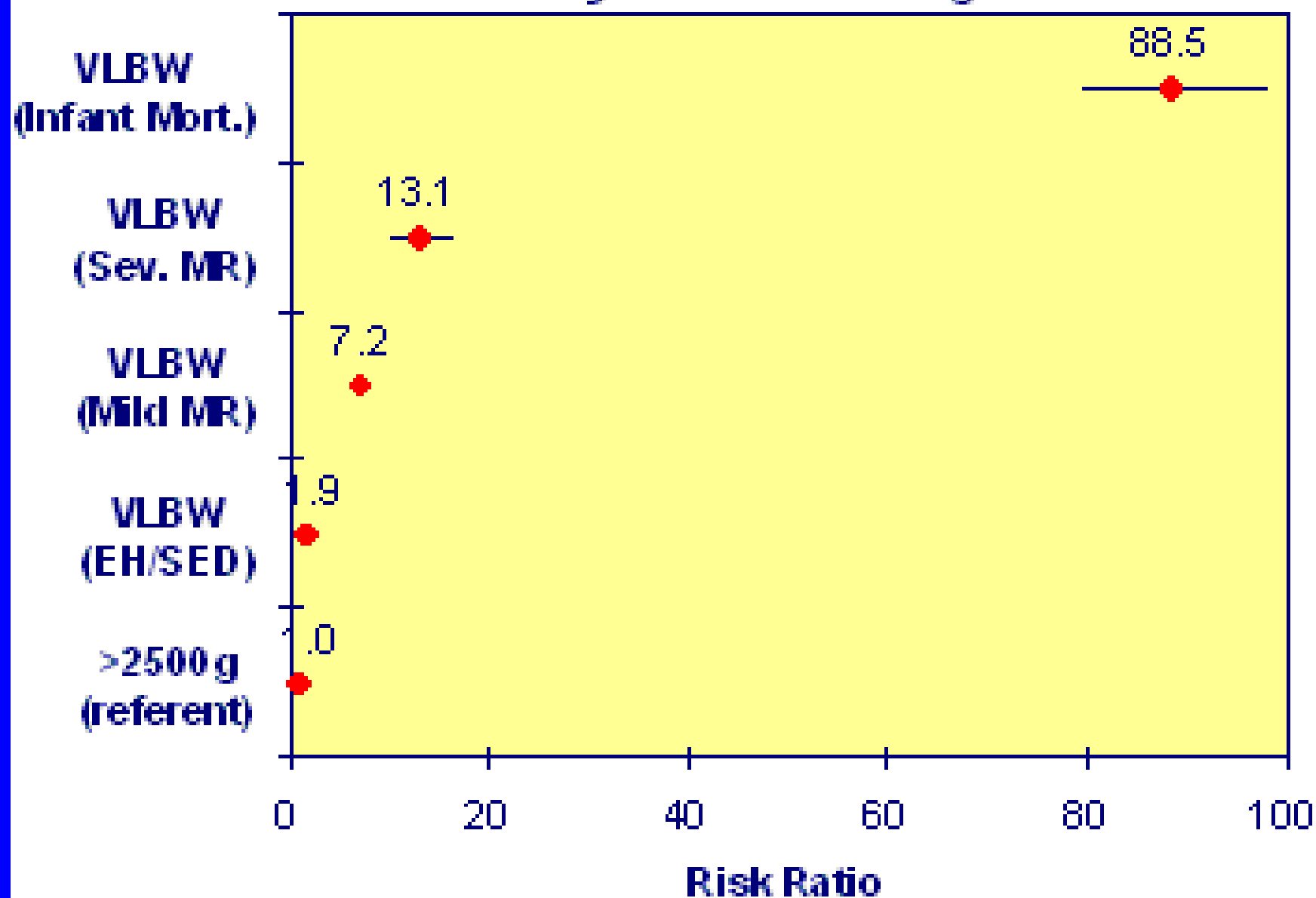
## Mod/Sev/Prof MR

<i>apgar &lt;4</i>	19.5 (11.5-33.0)
<i>vlbw</i>	13.1 (10.3-16.7)
<i>apgar 4-6</i>	12.6 (10.0-15.9)
<i>congen. abn.</i>	10.6 (8.8-12.9)

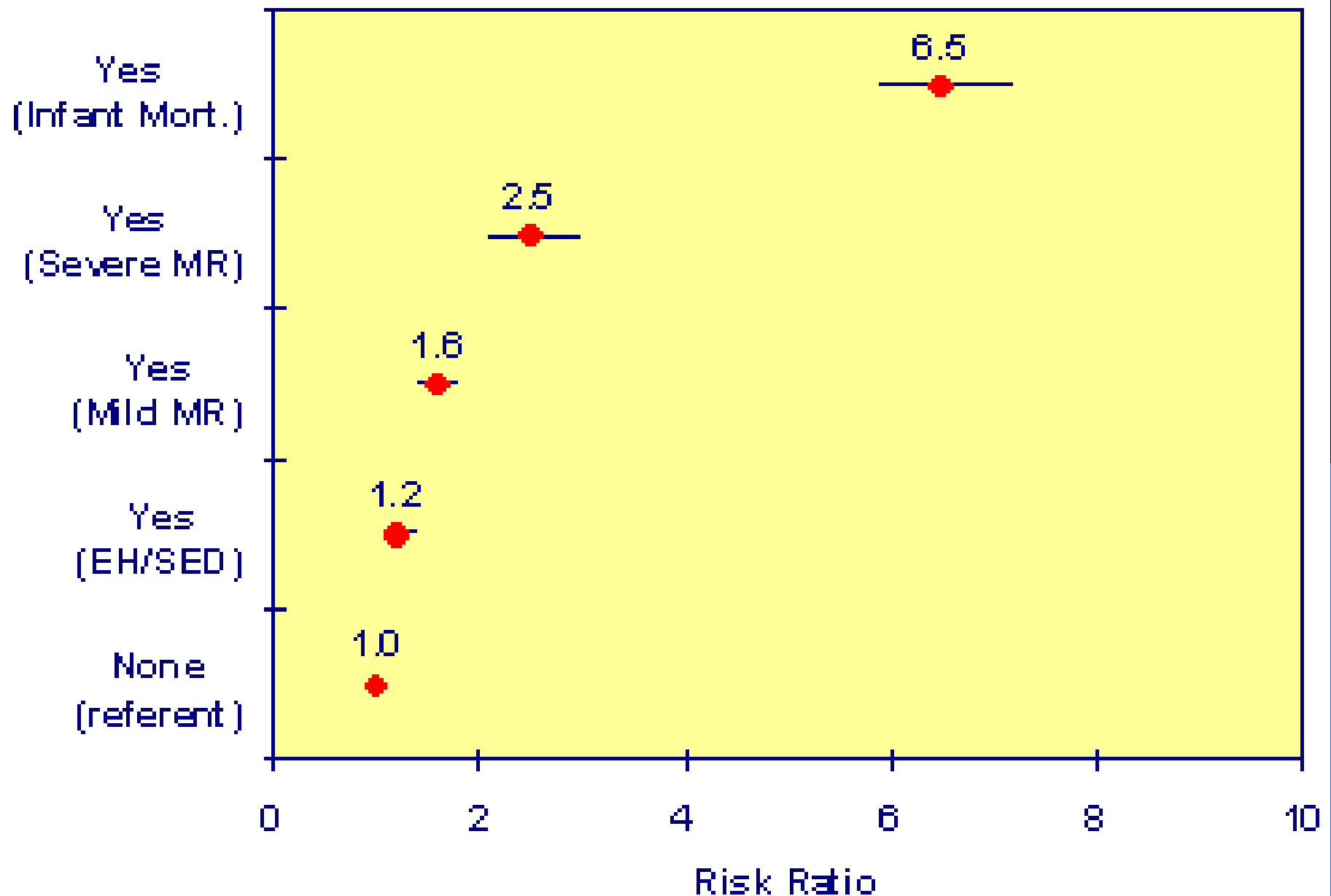
## Mild MR

<i>apgar 4-6</i>	8.3 (6.0-11.6)
<i>vlbw</i>	7.2 (6.2-8.4)
<i>mom ed &lt;12</i>	5.5 (4.9-6.2)
<i>dad ed &lt;12</i>	4.4 (3.9-5.1)
<i>apgar &lt;4</i>	4.1 (3.3-5.0)

## Very Low Birth Weight



## Newborn Abnormal Cond.



# Population Attributable Fraction Percent (PAF%)

- Pulls together information about:
  - *Risk* associated with exposure to a risk factor (RR)
  - *Prevalence* of exposure to a risk factor ( $P_e$ )
- Weights risk ratio by % of population that has experienced the risk factor

$$PAF \% = \frac{P_e(RR - 1)}{1 + P_e(RR - 1)} \times 100$$

# Population Attributable Fraction

- Proportion of cases in the population which are related to that risk factor
  - Reduction in cases if the rate in the risk group was reduced to the rate in the referent group

# Population Attributable Fraction

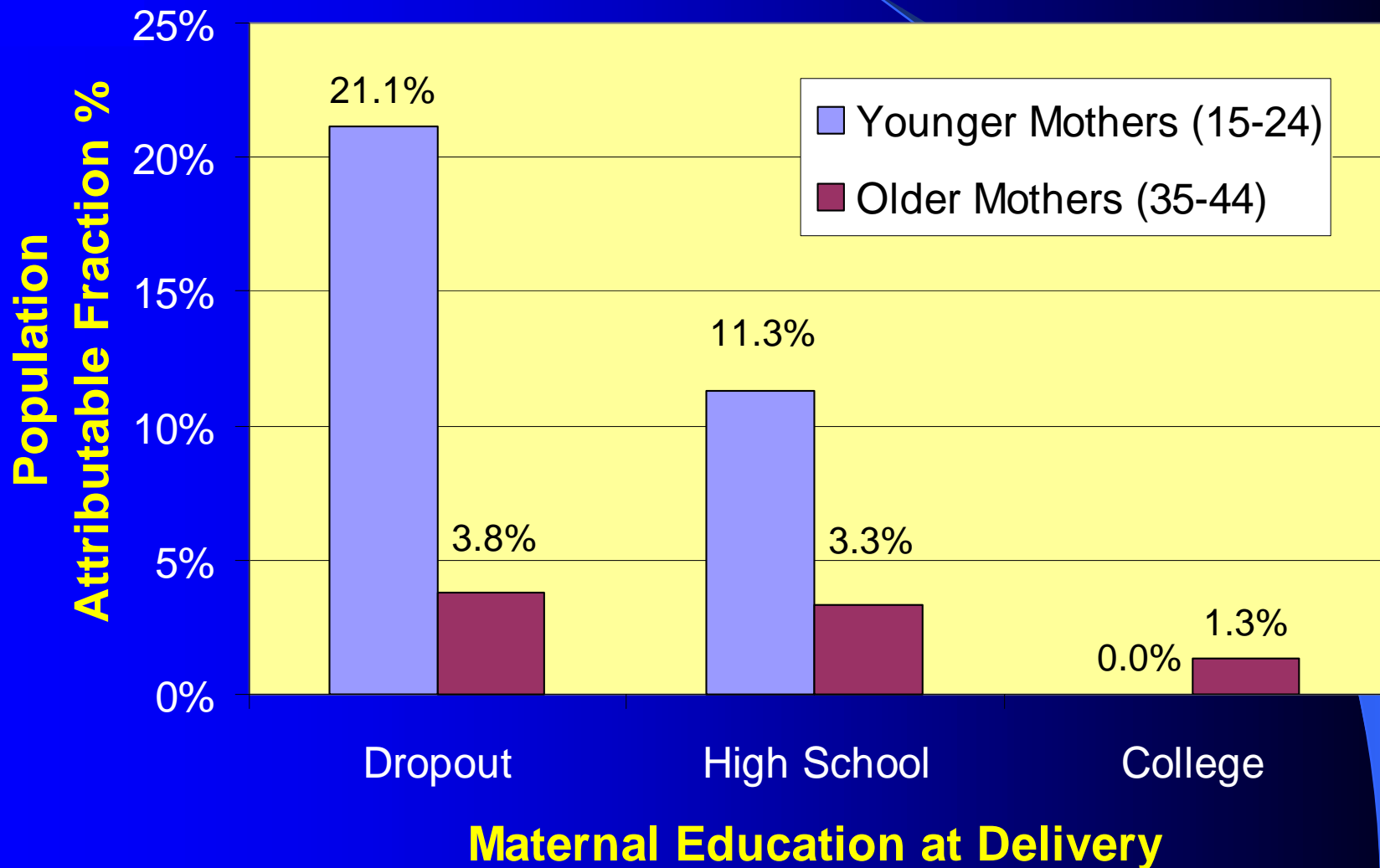
- Etiologic findings may direct useful strategies for prevention even when the biologic mechanism is not fully understood
  - Target services to group which is having the largest impact on overall rate in the population

# Date of Discovery of Preventive Measures vs. Date of Identification of True Causative/ Preventive Agent

<b>Disease</b>	<b>Discoverer of preventive measure</b>	<b>Year of discovery of preventive measure</b>	<b>Year of discovery agent</b>	<b>Causative or preventive agent</b>	<b>Discoverer of agent</b>
Scurvy	J. Lind	1753	1928	(Ascorbic acid)	A. Szent-Gyorgi
Pelleagra	G. Casal	1755	1924	(Niacin)	J. Goldberger et. al.
Scrotal cancer	P. Pott	1775	1933	Benzo{2}pyrene	J. W. Cook et. al.
Smallpox	E. Jenner	1798	1958	Orthopoxvirus	F. Fenner
Puerperal fever	I. Semmelweis	1847	1879	Streptococcus	L. Pasteur
Cholera	J. Snow	1849	1893	<i>Vibrio cholerae</i>	R. Koch
Bladder cancer	L. Rehn	1895	1939	2-Naphththylamine	W. C. Hueper et. al.
Yellow fever	W. Reed et al.	1901	1928	Flavivirus	A. Stokes et. al.
Oral cancer	R. Abbe	1915	1974	N'-itrosonornicotine	D. Hoffman et. al.

Wynder, E. L. (1993) Invited commentary: Studies in mechanism and prevention  
American Journal of Epidemiology, 139, 547-549.

# Mod/Sev. MR: Maternal Age x Maternal Educational Level (FL 82-84)



# Population-level Risk (FL&TN 89-90)

## Infant Mortality

Pe	RR	Risk Factor	PAF%
11%	17.4	<i>Pre-term</i>	65%
2%	62.0	<i>Apgar &lt; 7</i>	54%
2%	88.5	<i>VLBW</i>	51%
35%	3.2	<i>Labor/Del. Comp.</i>	44%
11%	6.5	<i>Newborn Cond.</i>	38%

## EH/SED

Pe	RR	Risk Factor	PAF%
52%	4.2	<i>Male</i>	62%
33%	3.1	<i>Unmarried</i>	41%
27%	3.7	<i>Mom Ed &lt;12</i>	35%
34%	3.2	<i>Dad Ed &lt;12</i>	23%

## Mild MR

Pe	RR	Risk Factor	PAF%
27%	5.5	<i>Mom Ed &lt;12</i>	44%
33%	2.8	<i>Unmarried</i>	37%
20%	4.4	<i>Dad Ed &lt;12</i>	29%
44%	2.5	<i>Dad Ed =12</i>	28%

## Mod/Sev/Prof MR

Pe	RR	Risk Factor	PAF%
52%	1.4	<i>Male</i>	19%
27%	2.0	<i>Mom Ed &lt;12</i>	19%
33%	1.7	<i>Unmarried</i>	18%
8%	3.4	<i>Pre-term</i>	16%

Pe = Prevalence of Risk Factor in Population

# Summary

- Patterns of risk vary based on:
  - Outcome & level of analysis
- Epidemiological approach useful for developmental researchers
  - Target high-risk populations
  - Estimate potential effects of an intervention
  - Form etiologic hypotheses
- Integrate biologic variables within their broader behavioral, cultural, and social contexts

The background is a solid blue gradient. A thin, light blue curved line starts from the left edge and curves downwards towards the bottom right. A larger, darker blue curved shape is positioned in the lower right quadrant, partially overlapping the main blue area.

# Using Research to Influence Policy

# Policymakers Need to Know...

- What *specific* actions can be taken to address a problem?
- Frequently concerned with the *population* (e.g. State Dept. of Health)
- Before spending \$\$ on an intervention:
  - Specific cost savings
  - Reduction in risk
  - Reduction in prevalence

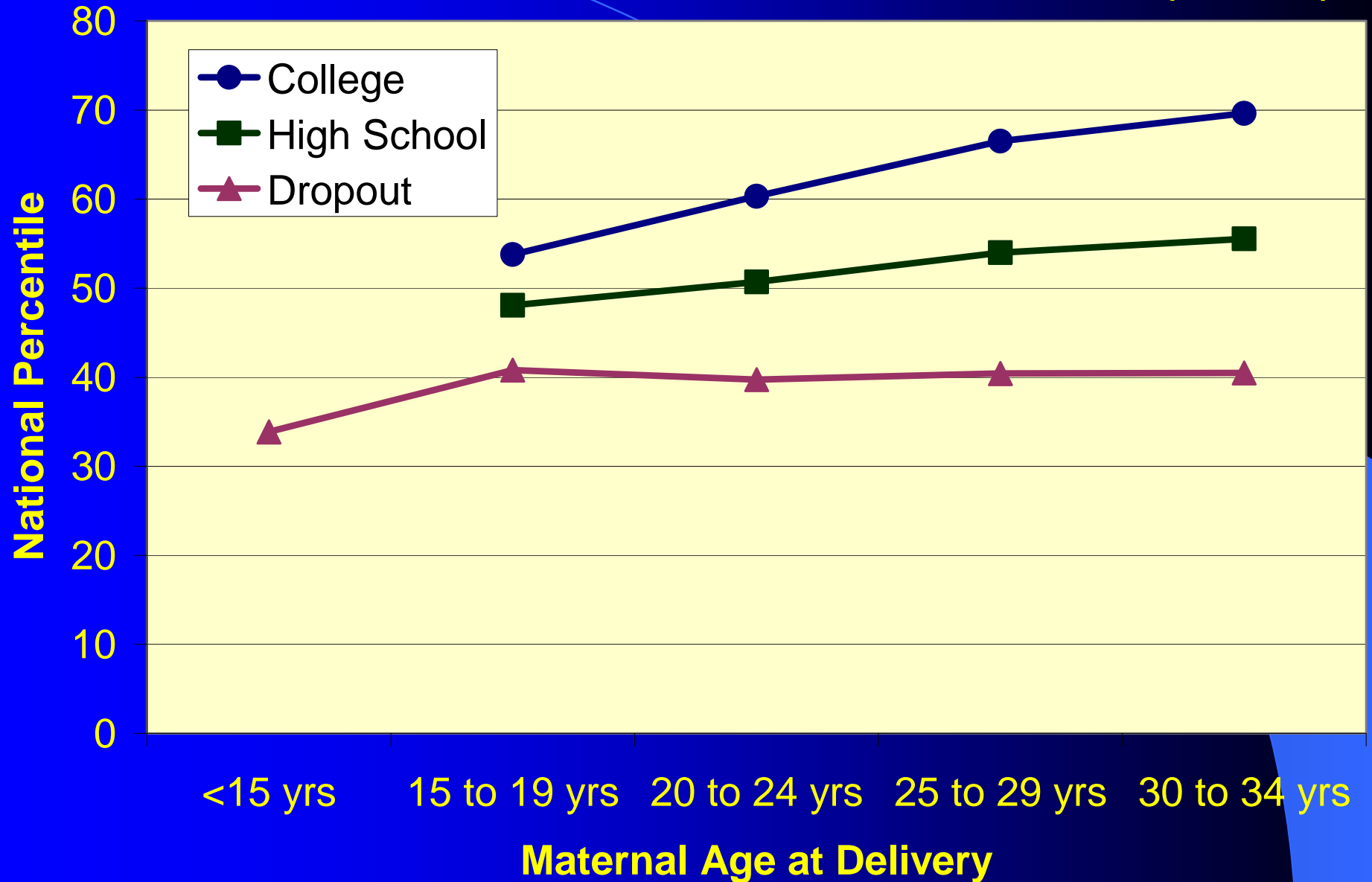
# Policy Reports Should. . .

- Be easily understood by those without a statistical background (legislators)
- Read quickly
  - Bulleted
  - Executive summary
  - Lots of graphs
- Contain specific recommendations for action

# Mean Reading & Math Total Score (National Percentile) by Maternal Age & Education

Maternal Education	Maternal Age	n	Reading (NP)	Math (NP)
<b>College</b>	<15 yrs	0	--	--
	15 to 19 yrs	589	48.88	53.77
	20 to 24 yrs	9,398	55.21	60.30
	25 to 29 yrs	18,485	61.47	66.48
	30 to 34 yrs	13,074	64.67	69.61
<b>High School</b>	<15 yrs	0	--	--
	15 to 19 yrs	6,270	43.67	48.08
	20 to 24 yrs	24,789	45.86	50.69
	25 to 29 yrs	20,199	48.50	53.98
	30 to 34 yrs	8,922	50.32	55.54
<b>Dropout</b>	<15 yrs	442	29.05	33.85
	15 to 19 yrs	11,369	35.82	40.82
	20 to 24 yrs	11,093	34.29	39.73
	25 to 29 yrs	6,099	33.81	40.42
	30 to 34 yrs	2,918	33.19	40.49

# Math Total Score (National Percentile) by Maternal Age and Maternal Education at the Time of Delivery (FL 89-90)



# Estimated Cost to Fill Gaps in Service, DCF/DS, Florida, 1998

**\$ 387,134**

[illegible]

## Key

**\$ = \$1000**

**\$ 16,891**

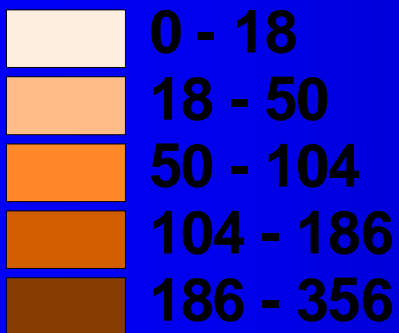
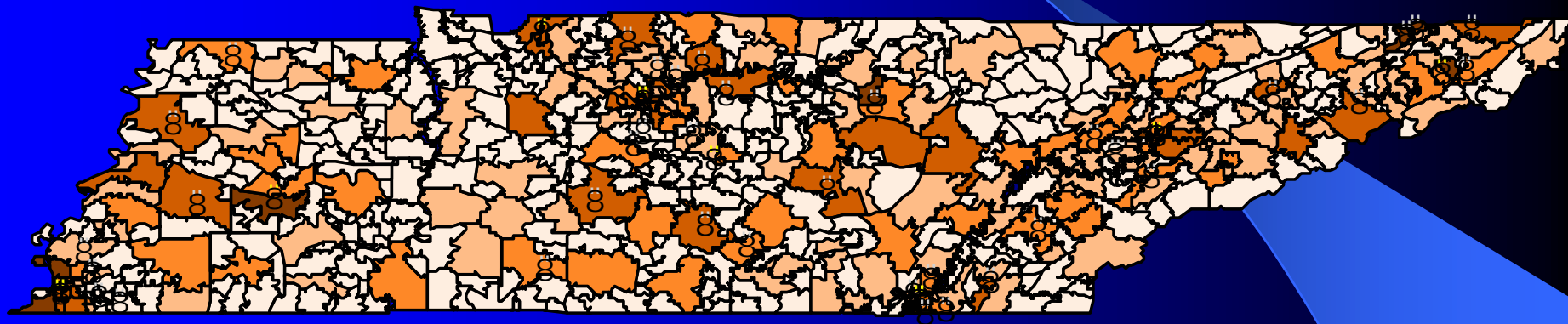
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# District 11

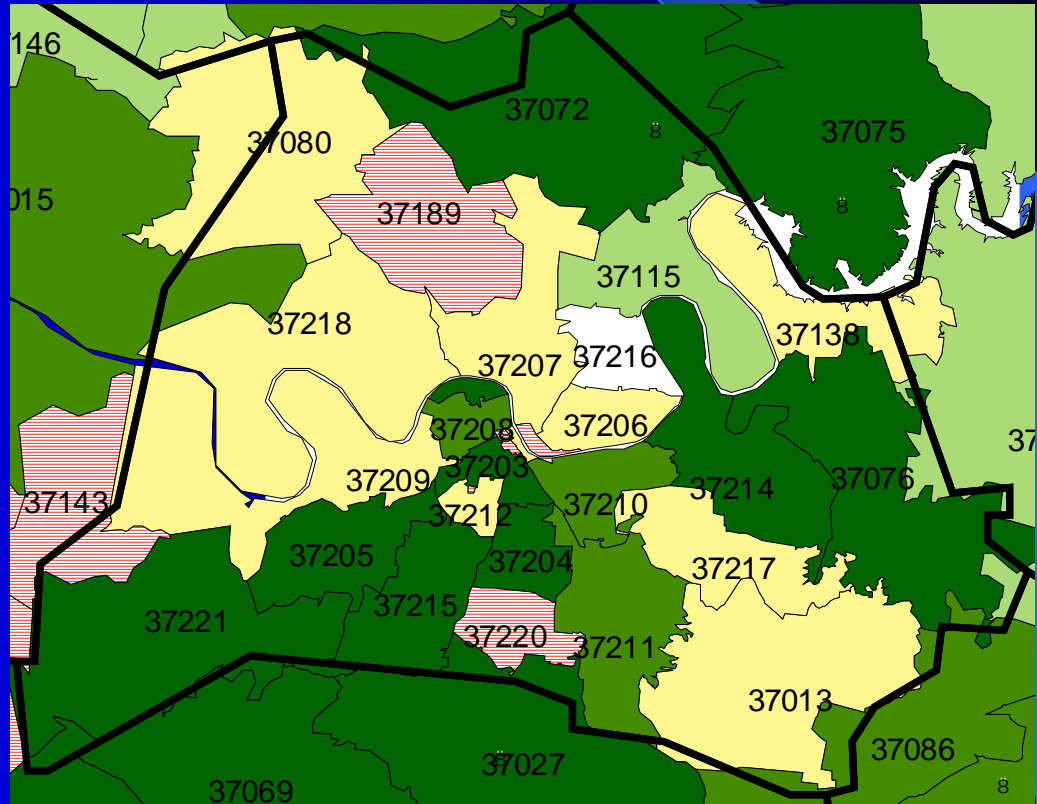
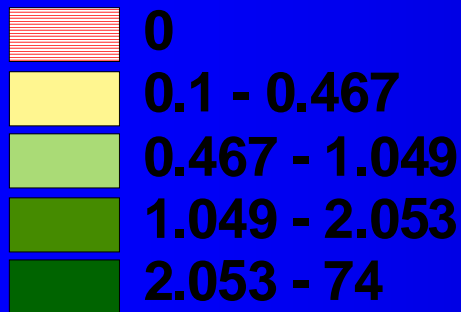
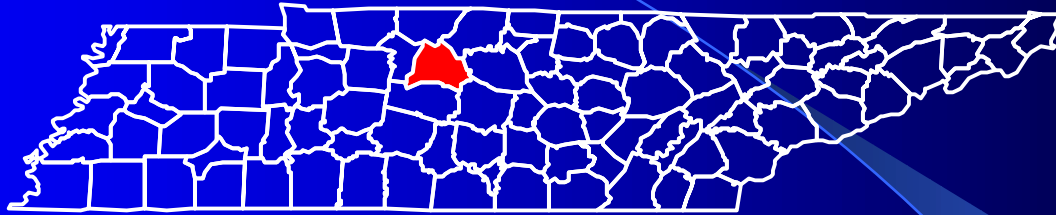
## District 2



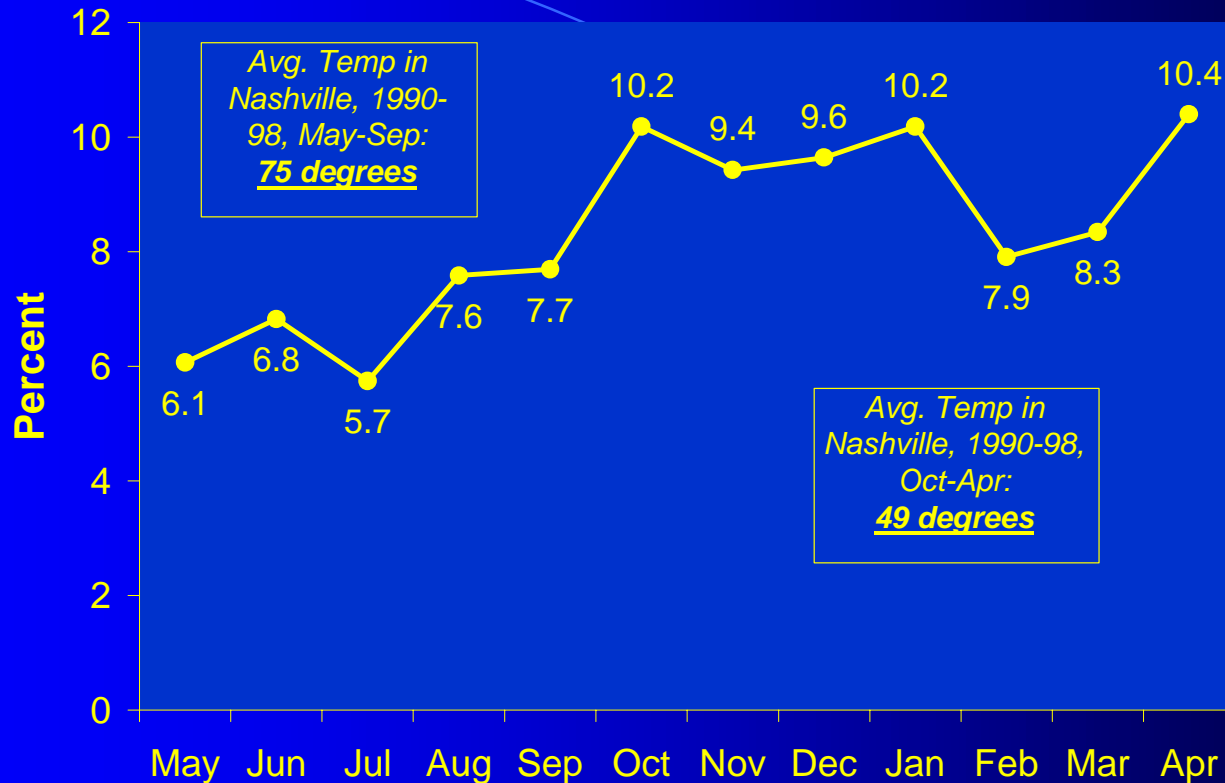
# DCS Clients by Zip Code, Tennessee, 2001



# Ratio of DCS Providers/Clients by Zip Code, Davidson County, 2001



## Percentage of SIDS Deaths by Month Tennessee, 1990-1998



- Some investigators have suggested that respiratory infections<sup>4</sup> and overheating due to thicker clothes and more bedding<sup>5</sup> during cold weather might precipitate SIDS in developmentally vulnerable infants
- Because 20-52% of SIDS victims are found with their nose and mouths turned into underlying bedding,<sup>6</sup> soft bedding including comforters and pillows should not be placed near infants<sup>7</sup>

## SIDS Rates by Maternal Smoking During Pregnancy Tennessee, 1990-1998



### *Smoking During Pregnancy*

The SIDS rate for mothers who reported smoking during pregnancy was more than three times that of mothers who reported that they did not smoke.

- Smoking is one of the most important *preventable* risk factors for SIDS.
- Mothers who smoke prenatally usually continue to smoke in the postnatal period.<sup>17</sup>
- “Public health interventions that focus on smoking cessation among pregnant women, and more particularly on primary smoking prevention efforts among teenage girls, may lead to a substantial decrease in SIDS. . .”<sup>18</sup>

# Online Sources of Health Statistics & Data

# HIT: Health Information Tennessee



Custom  
Query  
Links

**SPOT**

**TNKIDS**

**Maps/GIS**

Information  
Links

**About HIT**

**Tables**

**Reports**

**Site Map**



TENNESSEE DEPARTMENT  
OF HEALTH

A  
PARTNERSHIP  
BETWEEN



UTK COMMUNITY HEALTH  
RESEARCH GROUP

**Welcome to HIT!**

**Tennessee State  
Health Improvement Plan**

(URL address: "server.to/hit" or  
"http://hitspot.utk.edu/~chrg/hit/index.htm")

HIT is a public health informatics project to disseminate  
data interactively

**HIT Website**

[about HIT](#)[SPOT](#)[tables](#)[reports](#)[site map](#)[TN KIDS](#)[search](#)[maps/GIS](#)[feedback](#)[Links](#)

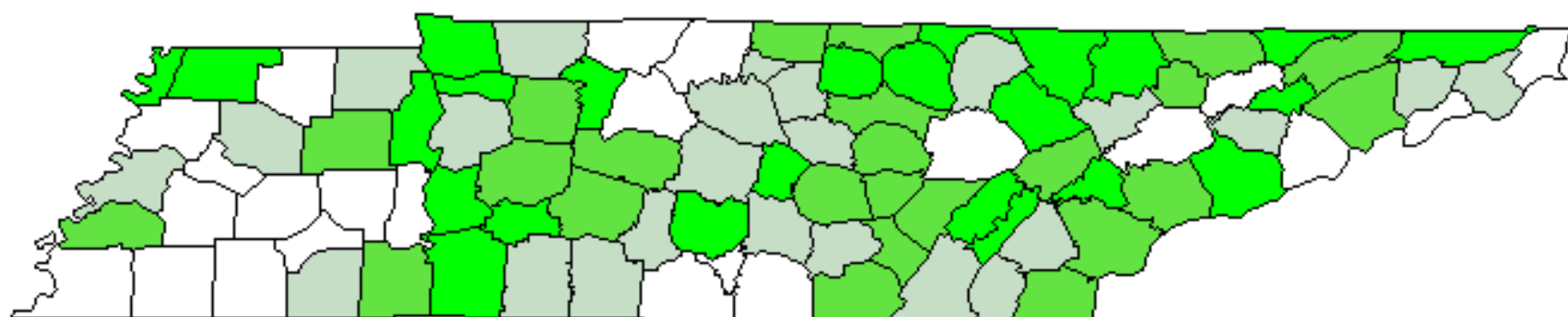
## SPOT (Statistical Profiling of Tennessee)

[Mortality](#)[Population](#)[Births](#)[Surveys](#)[Hospitals](#)[Nursing  
Homes](#)[Census](#)[Highway Crashes](#)[Schools](#)[TNKIDS](#)[HIT MapMaker  
Composite Data Mapping](#)

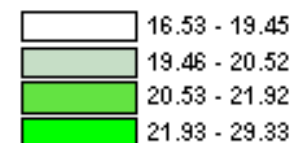
# Tennessee Alcohol- and Smoking- Related Mortality Data, Graduated Color Quantile Map

## % of All Deaths that are Smoking-Related -- 1998

*Source: Death Certificate Data, Tennessee Department of Health*



**% of All Deaths that are  
Smoking-Related -- 1998**



[about HIT](#)[SPOT](#)[tables](#)[reports](#)[site map](#)[TN KIDS](#)[search](#)[maps/GIS](#)[feedback](#)[Links](#)

## HIT MapMaker

[State/County Mapping](#)[County/Census Tract Mapping](#)

static Tennessee county detail maps below. The two buttons above serve as the gateway to interactive GIS capability!

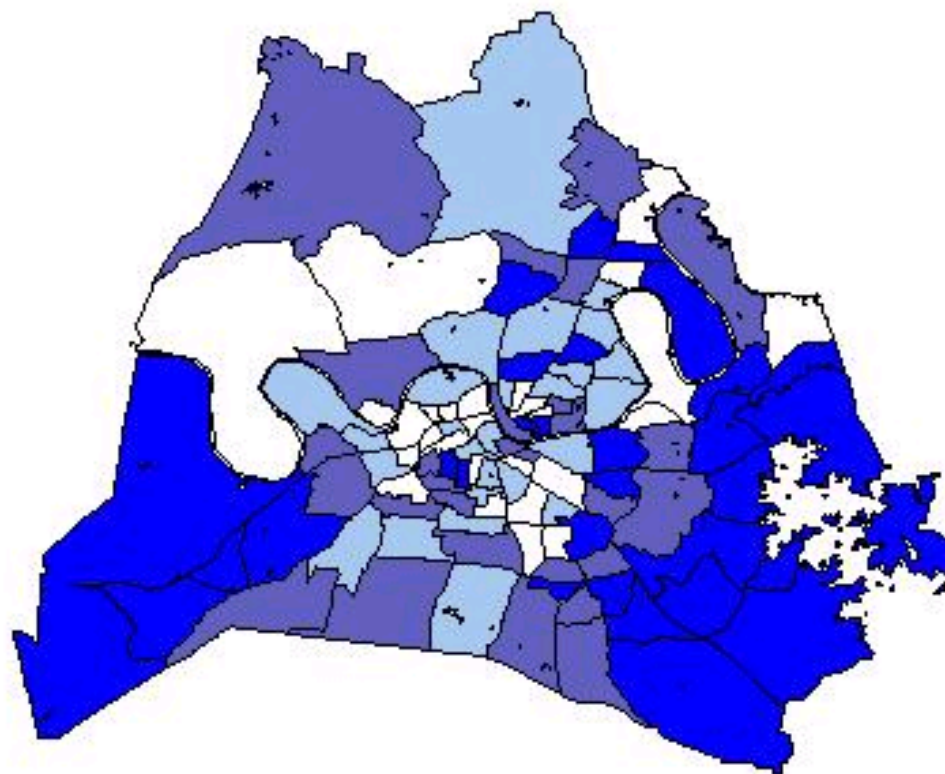
## County Detail Maps

<a href="#">Anderson</a>	<a href="#">Bedford</a>	<a href="#">Benton</a>	<a href="#">Bledsoe</a>	<a href="#">Blount</a>	<a href="#">Bradley</a>
<a href="#">Campbell</a>	<a href="#">Cannon</a>	<a href="#">Carroll</a>	<a href="#">Carter</a>	<a href="#">Cheatham</a>	<a href="#">Chester</a>
<a href="#">Claiborne</a>	<a href="#">Clay</a>	<a href="#">Cocke</a>	<a href="#">Coffee</a>	<a href="#">Crockett</a>	<a href="#">Cumberland</a>
<a href="#">Davidson</a>	<a href="#">Decatur</a>	<a href="#">DeKalb</a>	<a href="#">Dickson</a>	<a href="#">Dyer</a>	<a href="#">Fayette</a>
<a href="#">Fentress</a>	<a href="#">Franklin</a>	<a href="#">Gibson</a>	<a href="#">Giles</a>	<a href="#">Grainger</a>	<a href="#">Greene</a>
<a href="#">Grundy</a>	<a href="#">Hamblen</a>	<a href="#">Hamilton</a>	<a href="#">Hancock</a>	<a href="#">Hardeman</a>	<a href="#">Hardin</a>
<a href="#">Hawkins</a>	<a href="#">Haywood</a>	<a href="#">Henderson</a>	<a href="#">Henry</a>	<a href="#">Hickman</a>	<a href="#">Houston</a>
<a href="#">Humphreys</a>	<a href="#">Jackson</a>	<a href="#">Jefferson</a>	<a href="#">Johnson</a>	<a href="#">Knox</a>	<a href="#">Lake</a>
<a href="#">Lauderdale</a>	<a href="#">Lawrence</a>	<a href="#">Lewis</a>	<a href="#">Lincoln</a>	<a href="#">Loudon</a>	<a href="#">McMinn</a>

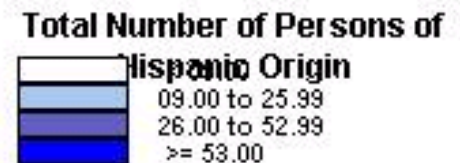
# Davidson County



**Davidson County**  
**Graduated Color Quantile Map of 1990 Census:**  
Total Number of Persons of Hispanic Origin, 1990



**Legends**





# Tennessee Mortality Rate Data

See [Tennessee Map](#) to view Regions and Counties

Select an Area:	Comparison Area:	First Year to Display	Last Year to Display	Pop. Estimation Method (See <a href="#">Usage Notes</a> )	3-Year Averaging
Tennessee ▼	Tennessee ▼	1990 ▼	1998 ▼	<input checked="" type="radio"/> 1997 <input type="radio"/> 1991	None Selected ▼
Select Race:	Sex:	Minimum Age:	Maximum Age:	Or Age-Group:	Age-Adjust?
All Races ▼	Both Sexes ▼	Under 1 ▼	85+ ▼	All Ages (Min-Max) ▼	No ▼

Select Cause(s) of Death (Up to 4)	OR Select Number
ALL CAUSES	None ▲
INFECTIOUS AND PARASITIC DISEASES (0-139)	1
Shigellosis, Amebiasis	2
Certain Other Intestinal Infections	3
Tuberculosis	4
–Tuberculosis of Respiratory System	5
–Tuberculosis, Other than Respiratory	6
Whooping Cough	7 ▼

Select a Presentation Type:
GRAPHICS - Bar Charts . . [1 or 2 Areas, 1+ Years, . . . . . 1 Cause or Category] ▼

Submit Query

[Data Description](#)

[Usage Notes](#)

[Samples](#)

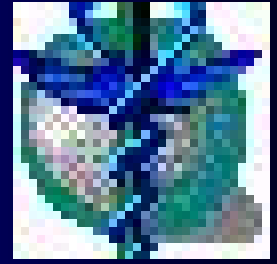


# CDC: The Data Web

- Home Page: [www.thedataweb.org/](http://www.thedataweb.org/)
- Data Sets:  
<http://www.thedataweb.org/datasets.html>
- Data Ferrett:  
<http://www.thedataweb.org/browser.html>



# CDC: Wonder



- Home Page: <http://wonder.cdc.gov/>
- Data Sets:  
<http://wonder.cdc.gov/DataSets.shtml>
- Scientific Data:  
[http://wonder.cdc.gov/wonder/sci\\_data/sci\\_data.asp](http://wonder.cdc.gov/wonder/sci_data/sci_data.asp)



- Home:

[www.cdc.gov/nchs/datawh.htm](http://www.cdc.gov/nchs/datawh.htm)

- Public Use Files:

[www.cdc.gov/nchs/datawh/ftpserve/ftpdata/ftpdata.htm](http://www.cdc.gov/nchs/datawh/ftpserve/ftpdata/ftpdata.htm)

- Links to other related sites:


<http://www.cdc.gov/nchs/sites.htm>

# U.S. Census Bureau

United States Department of Commerce

- Home Page: [www.census.gov](http://www.census.gov)
- Data Access:  
[www.census.gov/main/www/access.html](http://www.census.gov/main/www/access.html)
- Census 2000 FTP Site:  
[ftp://ftp2.census.gov/census\\_2000/datasets/](ftp://ftp2.census.gov/census_2000/datasets/)
- TIGER Files:  
[www.census.gov/geo/www/tiger/](http://www.census.gov/geo/www/tiger/)

# Miscellaneous

- CDC Chronic Disease Surveillance:  
<http://www.cdc.gov/nccdphp/surveil.htm>
-  FEDSTATS  
<http://www.fedstats.gov/>
- HealthFinder:  
[www.healthfinder.gov/scripts/searchContext.asp?topic=821](http://www.healthfinder.gov/scripts/searchContext.asp?topic=821)
- KidsCount: [www.aecf.org/kidscount/](http://www.aecf.org/kidscount/)

# Requesting Data From the TN Dept. of Health

# TDH Data Systems Resource Guide Online

- Health Statistics & Research:  
[www.state.tn.us/health/statistics/HealthData/hsr\\_healthdata.htm](http://www.state.tn.us/health/statistics/HealthData/hsr_healthdata.htm)
- Data Resource Guide:  
[www.state.tn.us/health/statistics/PdfFiles/ResourceGuide.pdf](http://www.state.tn.us/health/statistics/PdfFiles/ResourceGuide.pdf)

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